

Essentials for the Control of Ragweed*

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IT has been estimated that there are over 3,000,000 persons in the United States who suffer from hay fever caused by ragweed. The U. S. Public Health Service, in a leaflet on hay fever, states that ragweed grows in sufficient quantity in much of the territory east of the Rocky Mountains to produce symptoms of ragweed hay fever in an estimated 2 to 3 per cent of the inhabitants of the area. It is generally recognized by allergists that its prevalence has been steadily increasing from year to year. In a report on chronic diseases taken from the data collected in the National Health Survey conducted by the U. S. Public Health Service during 1935 and 1936, "hay fever and asthma" stood fourth in prevalence in a list of chronic diseases and was exceeded only by rheumatism, heart disease, and arteriosclerosis and high blood pressure. In this list, hay fever and asthma exceeded such chronic diseases as hernia, chronic bronchitis, cancer and other tumors, tuberculosis, diabetes mellitus, and others.

Thommen¹ estimates that pollen asthma occurs in about 35 per cent of all hay fever subjects in the New York area, and Huber¹ reports that pollen asthma occurs in about 54 per cent of the Chicago hay fever sufferers.

The discovery of the herbicide, 2, 4-dichlorophenoxyacetic acid opened a new field in public health by making it possible to eliminate ragweed from vast areas at a reasonable cost, only a fraction of that required for mosquito control.

Ragweed hay fever, then, can be said to be a fairly common disease and the weapon to control it is now available. It should, therefore, receive the attention of governmental authorities as a public health problem. R. P. Wodehouse, who is probably the best informed botanist on the subject of ragweed and its control, expresses his feelings on the subject in a letter written in 1939 to one of the authors as follows: "Hay fever can be cured by treating the environment instead of the patient. In fact it is the only way that it ever will be cured."

Before outlining the New York City ragweed control program, some of the essential knowledge necessary to bring about control of ragweed will be discussed.

For the past 25 years a considerable amount of information has been accumulated on the concentration of ragweed pollen in the air. One of the outstanding contributors is O. C. Durham² of Chicago. Much of this work has been done in response to the demand for information on the part of allergists and hay fever sufferers. The United States has been fairly well covered in a general

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way by data collected from a number of stations, made possible by the coöperation of the U. S. Weather Bureau. Maps are available which divide the United States into regions in accordance with the variations in the amount of ragweed pollen in the air, as shown by these spot checks.

In order to use the pollen content of the air as a device for evaluating ragweed control programs, it is necessary to plan the location and number of pollen sampling stations so that an adequate picture of the variation in pollen content throughout the areas can be obtained and accurate related meteorological and ecological data accumulated. It is possible that in the early stages of the development of ragweed control programs, the weather may have a greater influence on the pollen content in an area than the elimination of some of the ragweed plants. As ragweed control programs become effective over large areas, there will be a need for sufficient data to explain the presence of, or the year-after-year reduction in the ragweed pollen content in areas where the ragweed plants have been reduced in number or eliminated. It will not be sufficient to have the results of one or two stations used as an index of the completeness of a ragweed elimination program over an extensive area any more than one or two adult mosquito traps will serve as an index of the effectiveness of a mosquito campaign. It is recognized that there is a considerable difference between the distribution of adult mosquitoes from a source of breeding and the distribution of pollen from an area of ragweed plants. An air pollution survey in 1936 conducted by the New York City Health Department indicated a considerable variation in the pollen content of the air in the 5 boroughs of the city and this variation was related to the amount of vacant area in those boroughs.

In response to a demand for stand-

ardization of procedures in pollen collecting and counting, the American Academy of Allergy³ several years ago appointed a National Pollen Survey Committee to study and recommend standards for pollen collecting and counting. A preliminary report of the work of this committee has already been published which includes the recommended standards.

A group of allergists⁴ in the Division of Allergy of the Jewish Hospital of Brooklyn, in collaboration with the Pollen Survey Committee of the American Academy of Allergy, conducted studies during 1946 and 1947 in an attempt to shed some light on the influence of ragweed control programs on the pollen content of the air. They outline the reasons for their studies as:

1. To determine the relative ragweed pollen concentrations in various boroughs
2. To determine whether the pollen counts of Brooklyn and Manhattan, the only boroughs studied in the past, have been representative of the entire city
3. To determine to what extent ragweed pollination in surrounding communities influences New York's pollen problem
4. To collect data which might help to determine the effectiveness of the ragweed extermination campaign which is being carried on by the Department of Health in this city
5. To obtain further data on the relationship of meteorologic conditions to pollen counts

The plants, *Ambrosia artemisiifolia* and *Ambrosia trifida* (short and giant ragweed) are the principal cause of autumn hay fever. Ragweed pollen is buoyant, abundant, and has high allergenic toxicity. The seeds, which are dropped close to the plant are disseminated by water, animals, and man. They are heavy and do not ordinarily move far from the plants which produced them. Ecologists classify plants into 3 general categories: pioneer, intermediates, and climax vegetation. This natural phenomenon is known as plant succession. Pioneer plants⁵ are able to grow on barren soil serving as nature's

rescue squad to prevent the total waste of top soil. The most important pioneer plant is the ragweed. Where these pioneer plants are able to establish themselves they flourish over a period of years until they are able to restore the soil so that it will support an intermediate group of plants such as the late weed and grass plants. This process may take 10 or more years. As the intermediate plants establish themselves, the pioneer plants are forced out by competition. The ragweed plant is not only a pioneer; it is also a non-competitive plant. If left alone, this intermediate stage would then give way to climax vegetation. Only selected areas are ever allowed to return to climax vegetation. According to Wodehouse, the Indians had no hay fever because they lived in the primeval forest or on the native prairies. In those early days the land was clothed with climax vegetation. As the white man built cities and towns cutting down the forests and developing farms and highways, climax vegetation was removed and much of the soil was left bare. Hay fever is nature's reply to man's wasteful exploitation of natural resources.

Little is known of the ecology of the ragweed plants. A number of problems are already arising in connection with developing the most effective program of control. A study of the reaction of plants to the use of 2, 4-D on such a wide scale as practised in New York City during the past 2 years promises to develop some of the unknown facts.⁶ Ragweed plant ecology is as important to the future ragweed control programs as entomology has been to programs to control insects.

A quotation from a letter received in 1939 from a public health official indicates how easy it is to make mistakes in dealing with a question about which little is known. "I am puzzled as to whether your plan would be effective. For example, ragweed has not been

found in New York City and I am certain that within a radius of at least 10 miles of Fifth Avenue and 42nd Street there is no ragweed. The question therefore arises whether the pollen which is transmitted by wind from rural areas might not be more important in causing hay fever than that which grows within the bounds of a city."

Actually there were approximately 500 acres of ragweed growing in Manhattan. Within a radius of 10 miles there was probably as heavy a growth of ragweed as could be found in any similar 10 mile radius in this section of the country. In many sections of the country, as in this area, ragweed is an urban problem even more than a rural problem. Many of the projects built by man which remove plant cover from an area take place in cities, where farms are being abandoned and subdivided for development, where streets are being built without finishing the curbs and sidewalks, where rain run-off is being concentrated more rapidly in natural drainage ditches. Rural areas in general are more stable except perhaps along the highways. They may not be the main problem as visualized by health workers who have not tackled the problem of control in earnest.

Several years ago the selective herbicidal properties of the potent plant-growth-regulating substance 2, 4-dichlorophenoxyacetic acid (2, 4-D) and its derivatives were discovered. In 1945 sufficient quantities of this chemical became available.⁷ Thirty to 40 different manufacturers offered 2,4-D in the form of salts, esters, and related derivatives which, in a concentration of 0.1 per cent by weight, would kill broad leaf plants but not grasses and other resistant plants. The herbicide is absorbed by the plant, transferred to the lower stem and roots, causing the plant to starve. The first symptoms are bending and twisting of stems and leaves followed usually by swelling, cracking, and split-

ting of the stems, yellowing, browning, and drying up. The roots become spongy, enlarged, and water soaked.

The New York City Department of Health⁶ studied the possibility and practicability of using this herbicide to control ragweed on a city-wide basis. Two demonstrations showed that when it was applied as a 0.1 per cent solution, wetting about 90 per cent of the plant foliage, it would kill the weeds without injuring the grasses. Approximately 200 gallons were found to be necessary for one acre of ragweed and 1 crew, consisting of a spraying unit and 3 men, could spray approximately 2½ acres a day. Approximately one pound of 2, 4-D powder makes 100 gallons of the 0.1 per cent herbicide solution, bringing the cost of chemical to about \$2 an acre; 2, 4-D has certain advantages over chemicals that have been used in the past. It is non-corrosive, non-inflammable and will not explode. In addition, it is not poisonous to human beings.

Ragweed plants shed their pollen early in August and produce seeds a short time later. In order to obtain maximum benefits, the plant should be destroyed by the early part of August so as to prevent the shedding of pollen or the dropping of seeds. Ragweed is an annual plant, therefore, if all the plants were destroyed in any one year, there would be no ragweed seeds dropped to produce plants in future years. It is possible to destroy all of the ragweed seeds produced in an area that is properly sprayed in any one year. However, it is impossible to destroy all the ragweed seeds in existence as a small proportion of each year's crop of seeds remains viable in the soil and a few of these will grow when the soil is disturbed, exposing the seed. The number of plants growing from old seeds is small compared to the total annual crop of seeds once the ragweed plant has become generally established in an area.

The number of plants coming from the old seeds depends on the amount of soil which is disturbed by the abandoning of farm land and the barren soil left along the sides of new roads and areas where the cover crop is laid waste and the surface remains bare.

Experience indicates that the selective action of the herbicide hastens plant succession by killing the ragweed plant. It seems to encourage the growth of the intermediate plants, namely, late weeds and grasses. Indications are that the spraying of the ragweed plant aids in building soil. Extensive areas where both ragweed and other plants were growing, which were sprayed in the 1946 campaign, produced a solid growth of grasses and other plants during the season of 1947. The spraying not only killed the ragweed plants of that season, but hastened the phenomenon of plant succession, establishing the intermediate stage of plants which not only controls erosion but discourages the growth of the ragweed, a non-competitive plant.

Attempts to enforce city laws requiring property owners to destroy ragweed on their property have been not only costly in time consumed but also ineffective. Many property owners could not be located and others could not be induced to eliminate the weeds in time to prevent the spilling of pollen and the production of seeds. Centrally directed campaigns to eliminate seeds by cutting and grubbing on a city-wide basis, although more successful, have generally failed because of the cost and the fact that much of the work accomplished did not always prevent pollination. Plants grew back and pollinated and produced seeds in a few weeks' time. Wherever the soil was disturbed, dormant seeds were given an opportunity to germinate.

Much can be done to support a city-wide spraying program by securing the coöperation of property owners in eliminating ragweed from their property, particularly when they are living on it or

otherwise using it. The bulk of the ragweed growing on vacant lots along highways and in alleyways, however, must be controlled on a city-wide basis.

Highway and public works departments with a practical knowledge of the factors which promote the growth of ragweed plants, can do much to prevent their growth in the development and maintenance of streets and highways. There is a striking difference between the amount of ragweed growing along the depressed speedways in New York City and that growing along service roads feeding these highways, particularly in the suburban areas of the city. Plant cover is required to control erosion along the banks of the depressed highways and this cover, which is usually grass, Japanese honeysuckle or barberry bushes, provides the competition which prevents the growth of ragweed.

Due to a marked increase in city-wide budget costs during this post-war period, it was not possible to purchase new equipment. Therefore, all available community resources were utilized in the ragweed control program. The Commissioner of Health secured the whole-hearted support of the Mayor who personally requested the coöperation of a number of city departments which were most helpful in the development of a practical control program.

The Health Department was the coordinating agency having responsibility for planning the budget and providing technical and supervisory guidance. It also carried on education and public relations on a city-wide basis. Several ragweed sufferers' groups assisted in this part of the program.

The Borough Presidents' Offices, that have jurisdiction over the streets in New York City assumed responsibility for the spraying. They engaged the labor, routed the trucks and supervised the men doing the work. They also released the information regarding the

progress of the program in each borough.

The Department of Sanitation loaned the street flushers which were converted to provide power units for the spraying operations. The Department of Health and the Borough Presidents' Offices co-operated in properly equipping the trucks with hose connections, spraying nozzles and the like. The Park Department sprayed ragweed growing on the property under its jurisdiction. The Police Department, through its precinct safety inspectors, mapped the city showing the location and extent of all of the ragweed growing within its limits.

It is recognized that the control of ragweed is for the purpose of reducing pollen and, thereby, hay fever symptoms and should not be thought of in terms of a few square miles. The area of the City of New York covers over 320 square miles, but maximum benefits will require supporting programs in the adjacent communities. Considerable work has been done by the department to promote an interest in ragweed control programs throughout the metropolitan area of New York. This area includes sections of the States of New York, Connecticut, and New Jersey, and the area within a 50 mile radius of central Manhattan.

New York University, in coöperation with the Department of Health, conducted a course in the "Control of Plants Detrimental to Health." Two hour sessions were held on 6 Friday evenings during the spring of 1947. Over 100 people from the metropolitan area and even beyond took the course. A number of communities in this area initiated ragweed control programs, and it is anticipated that the number will increase from year to year as the success of these programs is demonstrated.

The Brooklyn Botanic Garden and the City Health Department sponsored a joint conference on the "Control of Plants Harmful and Annoying to Man."

This was an all-day conference and was attended by over 200 people including professional botanists, municipal and other official representatives of garden clubs. The Commissioner of Health of New York City called meetings of health officers and municipal officials from the metropolitan area to discuss the use of 2, 4-D for the control of ragweed. The Department of Health believes that within the next few years it will be possible to eliminate practically all the ragweed plants within the city limits, and every effort will be made to

extend the ragweed control program throughout the metropolitan area.

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Maternal and Child Health Training Program

The Johns Hopkins University School of Hygiene and Public Health has established a specialized program in Maternal and Child Health. Its "purpose is to provide advanced training for a limited number of special students in the broad field of Maternal and Child Health with emphasis on the integration of administrative, clinical, and preventive skills and with attention to current developments and trends in medical care. It is particularly adapted to the needs of administrators of Maternal and Child Health and crippled children's programs and of qualified individuals who wish to make a combined career as full-time consultant and administrator in the obstetric or pediatric

services of health departments or other agencies."

Students taking this work are expected to spend 11 months in residence, an 8 month academic year including the required courses for the Master of Public Health degree, and a summer period devoted to field and clinical work. Clinical facilities are provided through arrangements with the pediatric and obstetric services of The Johns Hopkins Hospital and the Maryland State and Baltimore City Health Departments.

The first small group of students is now in training. Further information can be secured from Paul Harper, M.D., Maternal and Child Health Division, 615 N. Wolfe Street, Baltimore 5, Md.